

E200 Manual



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Welcome and thanks for choosing ENAIR

You have acquired a wind turbine for home and industrial use, excellent energy efficiency and manufactured with high quality materials.



Please, prior to installing your wind turbine, read carefully the paragraphs "5. INSTALLATION" and "9. WARRANTY", there you will find instructions to register your installation and the warranty.

If you have any comments or questions to us, please contact our Customer Service department by writing to: info@enair.es

In this manual you will find all the details of operation and maintenance of our wind turbines.

Turbine Model:

Serial N.º:

Revision N.º:

MANUFACTURED BY:

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1. INTRODUCTION

- Objective

This manual is to describe the installation and maintenance processes of the E200 wind turbine to ensure correct installation and commissioning. Also making known a little bit of the Enair company.

- About Enair

Enair works with the illusion of collaborating in the transition to a sustainable energy model, which increasingly have more in weight renewable energy and distributed generation. For this ambitious target, Enair has an important R & D department, composed of professionals with extensive experience in the field of wind energy. This team is dedicated to developing products in which the design, reliability and efficiency are the main features.

Enair activity focuses primarily on small wind energy power, with a range that is currently composed of the models up to 50kW. For the development of this activity we have various specialized production centres in each of the subjects, spread throughout Spain, but mainly in the province of Alicante where ENAIR, has the headquarter a development centre and test field. In Castalla Alicante, our products undergo a first phase of essay, development and verification testing and then undergo successfully the most demanding certifications of the market.

This whole development process of the product part is supervised by David Bornay; who is dedicated since 1970 to develop different types of turbines of small and medium power until today. With innovative base, the whole team of ENAIR is continuously incorporating improvements to our turbines. According to recent market studies, we believe that you purchased the best wind turbine, which in his power range, and market available is.



2. SECURITY INSTRUCTIONS, PREVIOUS CONSIDERATIONS

Installing the Wind Turbine is a simple process. From the initial design phase, the ease of installation and operation has been sought, together with compliance with all the safety regulations applicable to this type of machine, both mechanical and electrical.

In order for all these safety measures to be complied with, a minimum and essential knowledge is required for the installation of electrical and constructive components. For this reason, it is necessary that before carrying out any installation, the personnel responsible for it, acquire the necessary knowledge.



Only qualified personnel should install or operate the Enair wind turbine.

When the rotor/nacelle is accessed, the wind turbine must be in emergency stop.

Check that the tower is grounded and meets the requirements of the manual.

It is important to read the manual carefully before installation. Improper installation could seriously damage the Wind Turbine.



The installation will be carried out with a wind speed of less than 10 m/s.

Performing the installation without complying with the above two warnings may void the warranty.

Before installation, they must ensure that all current occupational risk regulations are complied with and take the necessary precautions to ensure that work is carried out safely.

- Mechanical risks:

The rotation of the blades is a mechanical hazard. The blades can rotate up to 130rpm and cause significant damage and injury.

The components of the wind turbine must be handled with care. We recommend the use of cranes and slings in good condition for the installation of the nacelle and blades. Because of their weight and size they can cause serious injury and damage.



Installation and maintenance work must be carried out at a wind speed of less than 10 m/s.

Do not access the rotor/nacelle if the turbine is running.



- Electrical hazards.

The converter is a low voltage device; note the following electrical hazards for this voltage:

**Electrical voltage hazard**

The inverter operates at high voltage. All electrical work must be performed by qualified electrical installers.

**Attention hot surfaces.**

The inverter and inverter can be heated during operation. Do not touch when running.

The resistance can reach high temperatures during the operation of the wind turbine. **DO NOT TOUCH.**



Read the manual/supplementary documentation on inverter operation.

The dangers of low-voltage installation may be caused by the following risks:

- Direct contact with active parts of the system between two conductors or between an active conductor and earth.
- Indirect contact with elements that are accidentally live due to an installation fault.



Ensure that the drive is earthed to ensure protection against indirect contacts.

If during the installation or operation process, questions or doubts arise, you can contact Enair through the following channels:

Tel: +34 96 556 00 18

Email: info@enair.es

In this manual you will find all the details of your wind turbine and all the references to the additional documents.

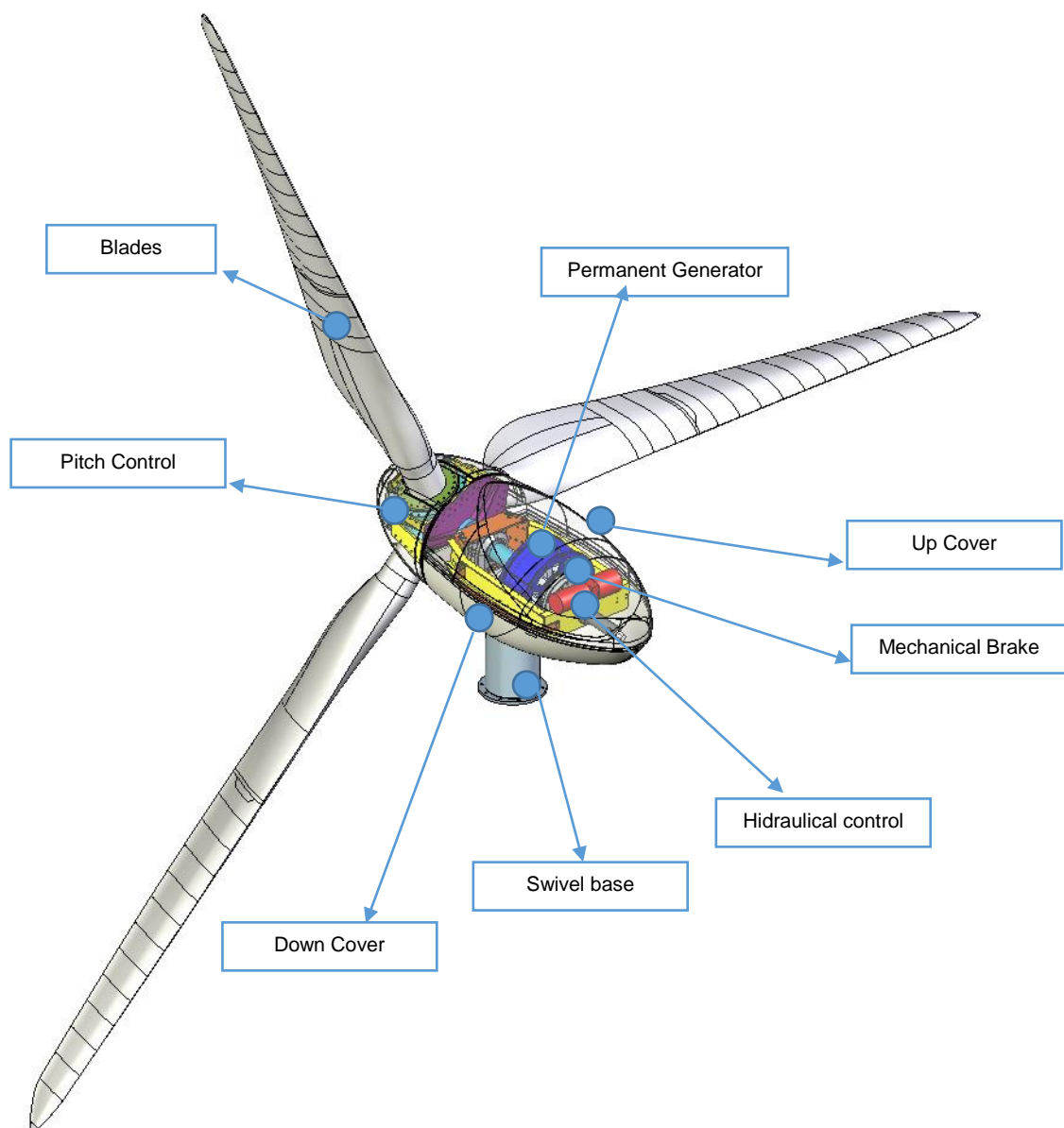


3. ABOUT SMAL WIND TURBINE ENAIR 200

ENAIR is a wind turbine belonging to the mini wind turbine sector with simple operation and easy assembly.

The Wind Turbine works downwind and the orientation is passive through the aerodynamics of the blades. The wind turbine transforms the kinetic energy of the wind into kinetic energy of rotation. The active variable pitch system is programmed so that, when the required wind speed is reached, it automatically searches for the starting position and adjusts the angle of the wind speed. This regulates the speed of rotation and power generation for low and high wind speeds. In the generator it transforms this kinetic energy of rotation into electrical energy.

The wind turbine has a main structure, the nacelle, where all the elements are integrated, covered by the fiberglass casing. At the rear there is another structural block, the rotor, which supports the blades and the active variable pitch, protected by a fibreglass cone.



4. DECLARATION OF CONFORMITY

- SMALL WIND TURBINE NORMS
 - IEC61400-2, Wind turbines. Part 2: Small wind turbines. Design requirements for mini wind turbines.
 - The international standard IEC 61400-2 ensures quality requirements as well as specific safety requirements for small wind turbines, including design, installation, maintenance and operation under specific outdoor conditions.
 - Eurocode 3: Design of steel structures DS/ENV1993-1-1-1

5. RULES ON INVERTER

- The Enair 200 wind turbine is compatible with different types of photovoltaic inverters. The necessary characteristics to determine compatibility are that these inverters have the ability to be programmed so that the DC current generation source can be set to a fixed value between 600-700V.
- The brands currently tested by Enair are: Fronius, SMA, Solis and Aros-Rielo. However, the inverter in these wind turbines will always be supplied by Enair, in order to guarantee compatibility with the wind turbine as well as with the standards applicable in each country. Las directivas aplicadas normalmente en los inversores son las establecidas por la UE:
 - Electromagnetic Compatibility 2014/30UE(29/3/2014 L96/79-106)(CEM)
 - Low Voltage 2014/35/UE (29/3/2014 L96/357-374)(DBT)
 - Radio equipment 2014/53/UE (22/5/2014 L153/62)(DER)

The grid connection compliance rules for the European market are: ÖVE / ÖNORM E 8001-4-712, DIN V VDE 0126-1-1/A1, VDE AR N 4105, IEC 62109-1/-2, IEC 62116, IEC 61727, AS 3100, AS 4777-2, AS 4777-3, CER 06-190, G59/3, UNE 206007-1, SI 4777, CEI 0-16, CEI 0-21

For the American market, they are: UL 1741-2010, UL1998 (for functions: AFCI and isolation monitoring), IEEE 1547-2003, IEEE 1547.1-2008, ANSI/IEEE C62.41, FCC Part 15 A & B, NEC Article 690, C22. 2 No. 107.1-01 (September 2001), UL1699B Issue 2 -2013, CSA TIL M-07 Issue 1 -2013



6. WARRANTY

LIMITED WARRANTY CONDITIONS

ENAIR ENERGY S.L. guarantees that the mechanical and structural parts of ENAIR wind turbines are free from material and manufacturing defects for a period of 36 months from the date of purchase or 40 months from the date of manufacture of the product, under normal use and subject to proper installation, commissioning and periodic maintenance. And electrical and/or electronic parts, such as control systems (Vacon-Danfoss componenets), are guaranteed for 24 months from installation.

The warranty covers the repair or replacement of defective parts and labour in our workshops in Castalla - Aicante (Spain). The shipping costs to the factory are borne by the customer and the return costs are borne by Enair.

WARRANTY EXCLUSIONS AND LIMITATIONS

This warranty does not apply if the customer or user has not returned the warranty card duly completed. The warranty does not cover wind turbines that have not undergone the periodic maintenance indicated in the manual and are properly sealed.

In general, the warranty claims set forth herein shall not apply to damage and malfunctions or failures in the operation or service of ENAIR wind turbines originating from:

- 1) Misuse, neglect, improper or inappropriate use of the product.
- 2) Failure to comply with the instructions for installation, use, maintenance and periodic inspections, established in the equipment manual, and with current local, national or international technical and safety regulations applicable at all times (Low Voltage Electrotechnical Regulations and Complementary Technical Instructions, Electromagnetic Compatibility, etc.).
- 3) Handling by unqualified personnel. Competent personnel means professionals with experience in electrical installations, companies dedicated to the distribution, sale or installation of Renewable Energy.
- 4) Modifying any parameter of the internal software of the Wind Turbine will automatically eliminate the warranty.
- 5) Damage caused by natural accidents (floods, plagues, earthquakes, hurricanes, cyclones, tornadoes, lightning, hail, fires...), vandalism, actions of third parties or any other cause of force majeure beyond the normal operating conditions of the equipment and the control of ENAIR ENERGY S.L.
- 6) Impact of flying objects, whether or not due to force majeure.
- 7) Tower or structural failure when not supplied by ENAIR ENERGY S.L.
- 8) Products not fully paid

The warranty claims set forth herein do not cover the transport costs of the wind turbines or defective elements, derived from the return to ENAIR ENERGY S.L. It also does not cover the costs of intervention arising from the disassembly of the defective equipment, nor does it cover



the costs of subsequent reinstallation of the replacement equipment.

ENAIR ENERGY S.L reserves the right to supply a different model of wind turbine or component to meet accepted warranty claims, by way of replacement and in the event that the original model has ceased to be manufactured. In this case, the new model will be of equal or higher performance.

ENAIR ENERGY S.L. reserves the right to cancel the guarantee of the product to those wind turbines that have been modified in paint, adhesives or other surface elements that modify in any way the external appearance that the Wind Turbine had when leaving the factory, without the prior written consent of ENAIR ENERGY SL.

ENAIR ENERGY S.L. undertakes to make use of the obligations described in the Conditions of this Limited Warranty and, in the event of repair or replacement by default attributable to the manufacturer, to cover the transport costs of subsequent replacement to the address registered at the customer, and to have them at its disposal within a maximum of 180 days from the date of receipt.

If ENAIR ENERGY S.L. determines that the problem with the wind turbine is not due to a material or manufacturing defect, the Customer shall be responsible for the costs of carrying out the tests and processing.

Defective Products that do not meet the specifications will become the property of ENAIR ENERGY S.L. as soon as they have been replaced or paid for.

Any return of material or replacement by ENAIR ENERGY S.L. under the terms of the Warranty constitutes a full settlement and release of all subsequent claims by any person covered by any damages or other form of repair, and will be an impediment to any litigation subsequently brought to the person who accepts such an agreement.

LIMITED WARRANTY CONDITIONS

ENAIR ENERGY S.L. shall not be liable to the customer, either directly or indirectly, for any breach or delay in the application of its warranty obligations, which may be caused by force majeure or any other unforeseen incident beyond the control of ENAIR ENERGY S.L.

The liability of ENAIR ENERGY S.L. arising from this Warranty Certificate shall be limited to the obligations expressed above, and any liability for indirect damages such as loss of operating income or profits shall be expressly excluded.

When the object of the claim is the consequence of an incorrect installation, ENAIR ENERGY S.L. will only be responsible when such installation is explicitly part of the scope of supply of the sales contract.

Any other warranty claims not expressly mentioned in this certificate are excluded.



7. PACKING LIST

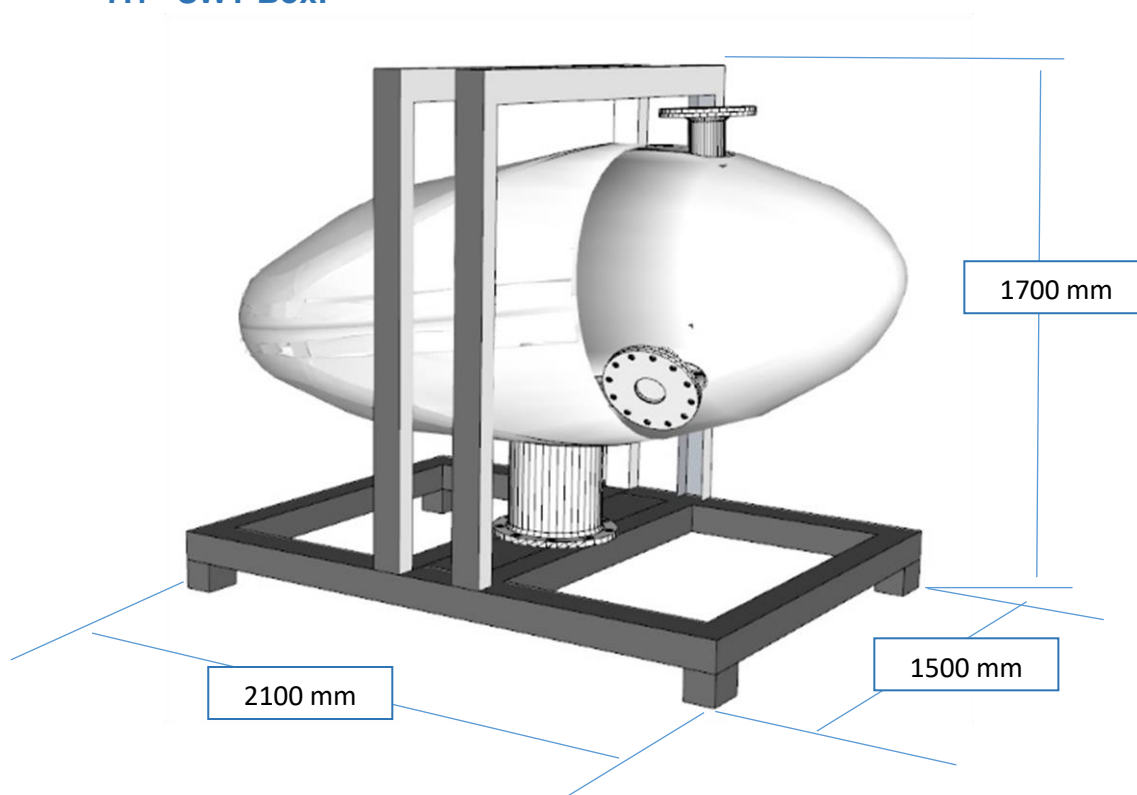
The Enair E200 wind turbine comes in its complete purchase in 4 packages, 2 packages are the whole of the wind turbine plus blades, another is the control system and the remaining is the tower.

E200 Tower:

Only for those who have the tower included in their purchase order.

The tower and its components are described in Annexes 1-A and 1-B. It is recommended to purchase the tower, however it is possible to purchase the wind turbine without it. In this case you do not need to consult the annexes mentioned above.

7.1 SWT Box:



7.1.1 Check list SWT - BOX:

list	Subcomponents	Code	Units
	Cone	CE200	1
T1	Up Cover	CSUE200	1
T2	Down Cover	CSIE200	1
T4	Anemometer	AE200	1
T5	Wind Turbine	DB200	1
Weight Turbine			1000 Kg
Total Weight			1300 Kg

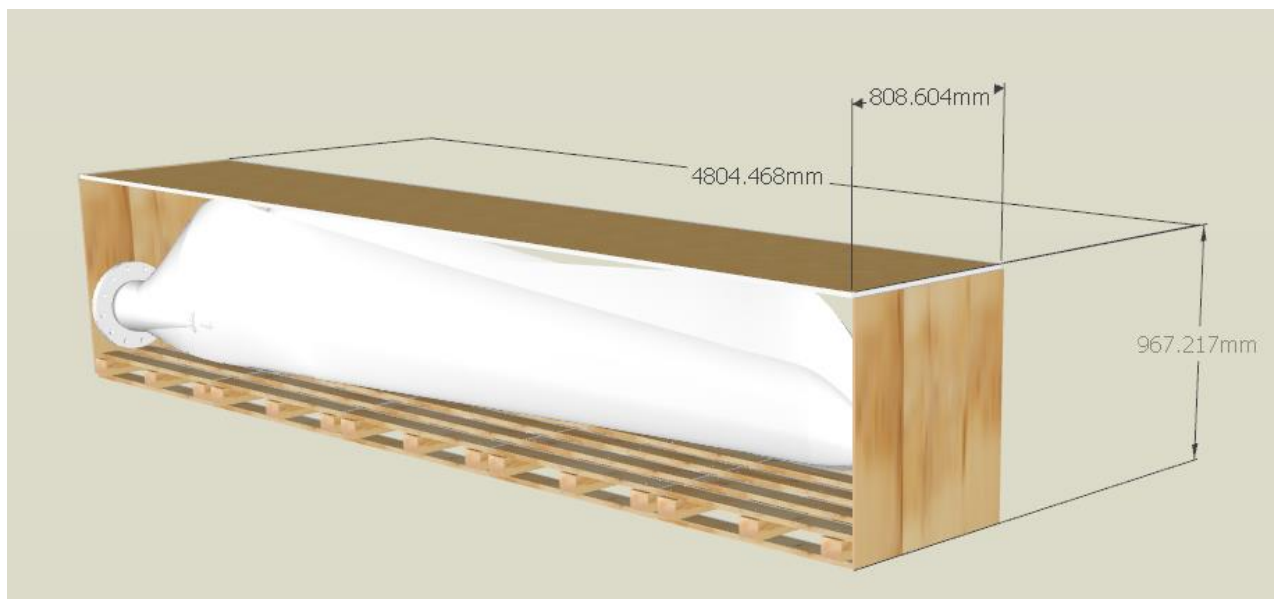


7.1.2 Tools to assembly the windturbine:

Tools		Quantity
T0	Fix Key of 24mm – Par 198 Nm (Anexo -3)	1
T1	Glass 24 mm	2
T2	Allen wrench of 8	1
T3	Dinamometric since 200Nm	1
T4	3m textile sling	4
T5	Shackles for tying shackles	4
Recomendaciones		
	Cordless drill with adjustable torque	1



7.2 Blades Box:



7.2.1 Check list Blades:

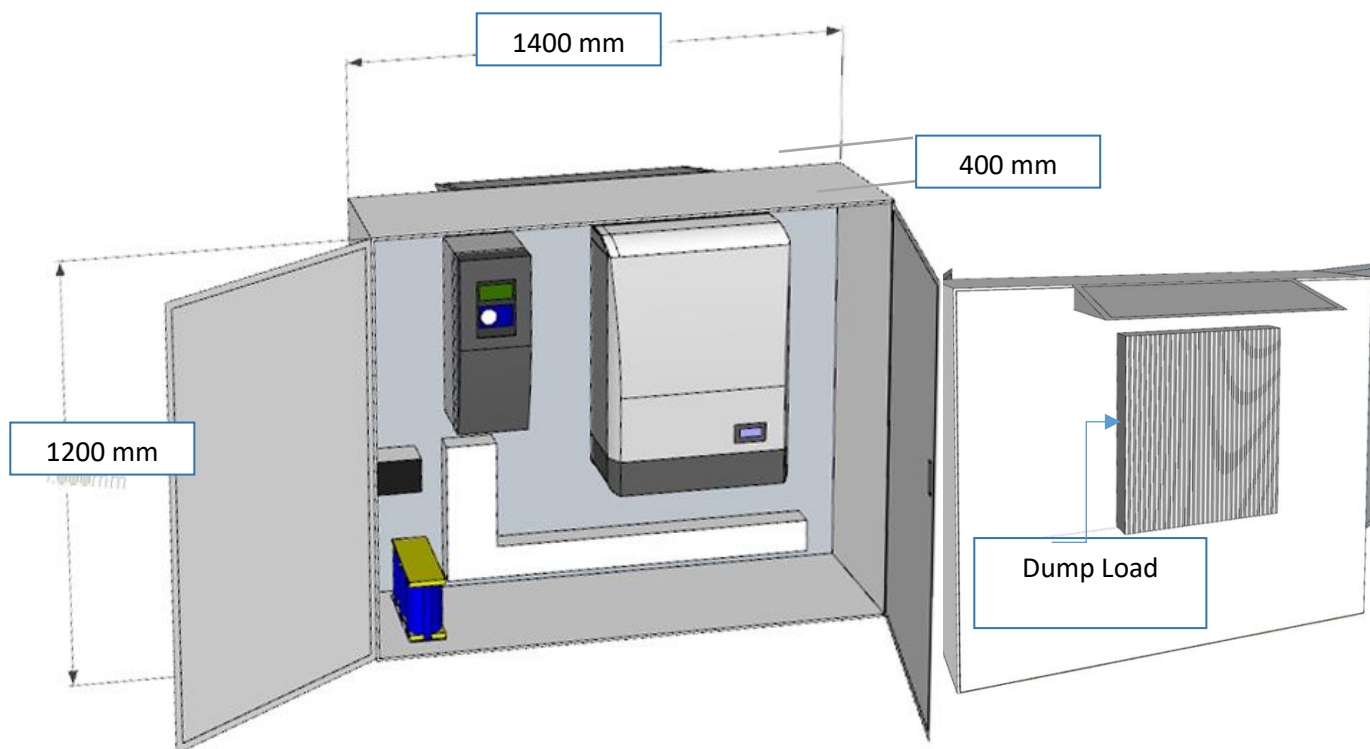
	Subcomponents	Code	Units
T0	Blades	P0048	3
T1	Screws Kit	TM14	1
Blade Weight			140 Kg
Total Weight			470 Kg



7.2.2 Herramientas montaje de las palas:

	Tools	Cantidad recomendada
T0	Fix Key M. 21 – Par 127 Nm (Anexo -3)	2
T1	Socket spanner of 21 mm	1
T2	Ratchet wrench	1
T3	Dinamometric since 200Nm	1
T4	Textile sling de 6m	2
T5	Textile sling 0.6m	2
Recomendaciones		
	Cordless drill with adjustable torque	1
	Torque wrench up to 72Nm	1

7.3 Control Box:



7.3.1 Control Box Check list:

	Subcomponents	Code	Units
T0	Box	AME200	1
T1	Dump Load	RE200	1
T2	Kit of screws	KFE200	1
Total Weight			350Kg



7.3.2 Mounting tools control box:

	Tools	Quantity
T0	Screwdriver	2
T1	Star screwdriver	2
T4	Universal pliers	1
T5	Cutting pliers	1
Recommendations		
	Cordless drill with adjustable torque	1

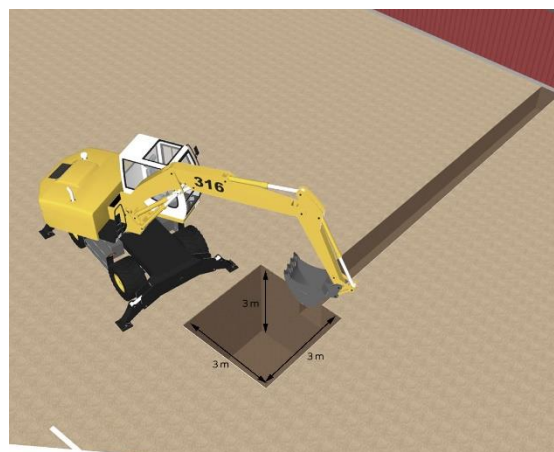


8. INSTALLATION

The installation process may vary depending on the type of tower selected, for the Enair 200 wind turbine, several types of towers are available. These can be square lattice, tubular or cable-stayed. For the explanation of the manual we selected the option of lattice towers because it is the standard model.

Dig the foundation hole

Carry out the excavation work and the trench corresponding to the place where the equipment will be connected. The middle hole consists of 3x3x3 meters for towers of 20m in height. It is recommended to make a cleaning concrete and build concrete to give it more strength. This job requires an excavator and a supervising installer technician only.



Place the first tower section

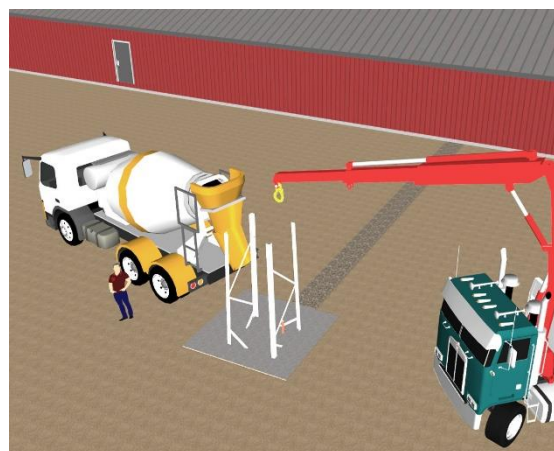
When the hole is made, it is necessary to put the wiring tube and insert the first section of the tower to be able to pour the concrete later. 27m³ of concrete is required and the type of concrete can be the building standard of your country. Quick concrete is recommended and that is minimally reinforced for greater strength. This work requires a small crane to place the tower and a technician installed



Allow the foundations to set

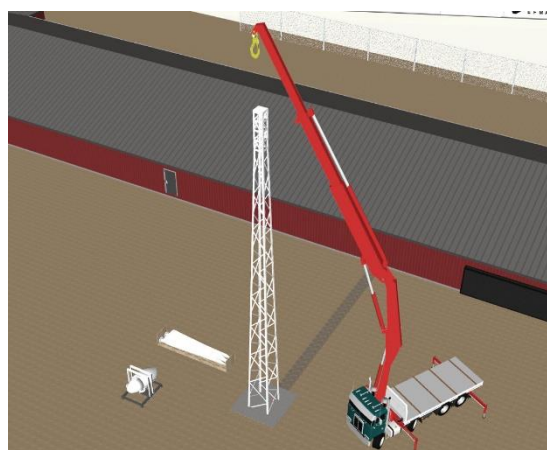
Depending on the type of concrete used, the solidification time of the foundation can be delayed from 48 hours to 2 weeks.

Once it is consolidated, the next installation process will proceed.



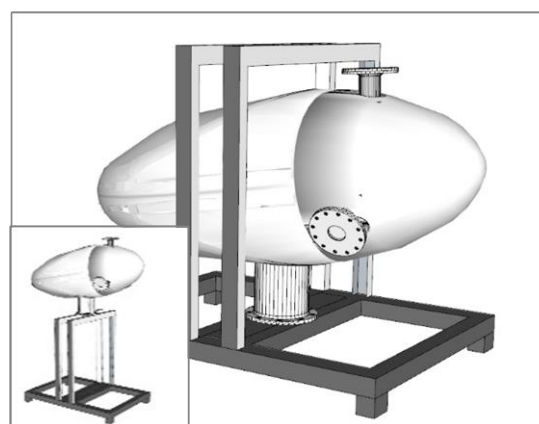
Install the rest of the tower

Assemble the tower on the floor according to the indications of each of the steel profiles and the tower assembly manual. Once assembled on the ground, tighten the screws well, take it from the upper ends with the crane and assemble it on the cimeted section.



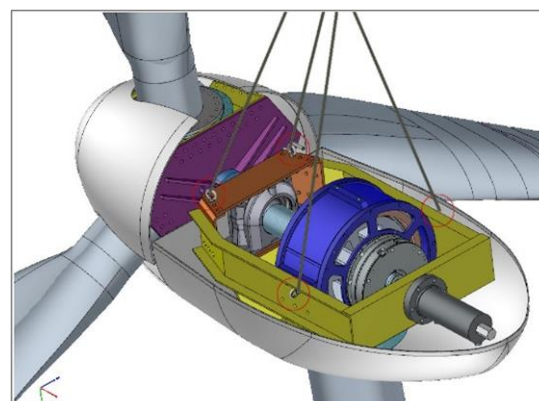
Unpack

The packaging has a support structure made of steel designed to place the wind turbine on it and facilitate assembly.



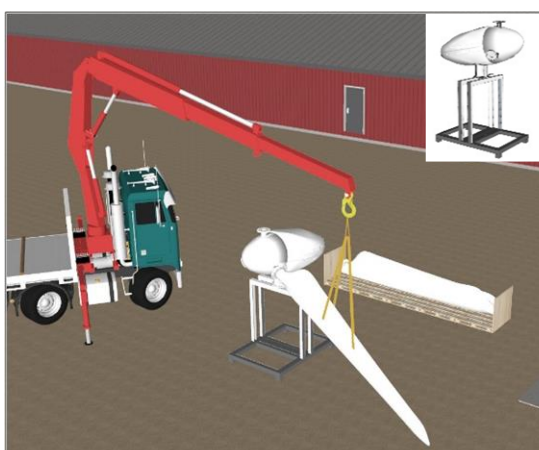
Mooring of the wind turbine

To raise the wind turbine, rings should be used anchored at the elevation points marked in the image. There are four lifting points that are placed so that the machine rises in a level way.



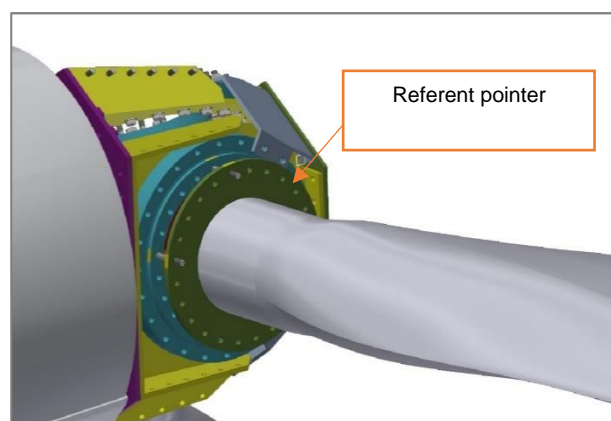
Mount the blades on their packing structure

The packaging structure with which the wind turbine is transported is ready to be placed on it and used as a mounting base. By placing the wind turbine on it, with the crane the blades of the lower part are first mounted and then the upper blade. For this work 2 people are recommended, plus the help of the crane.



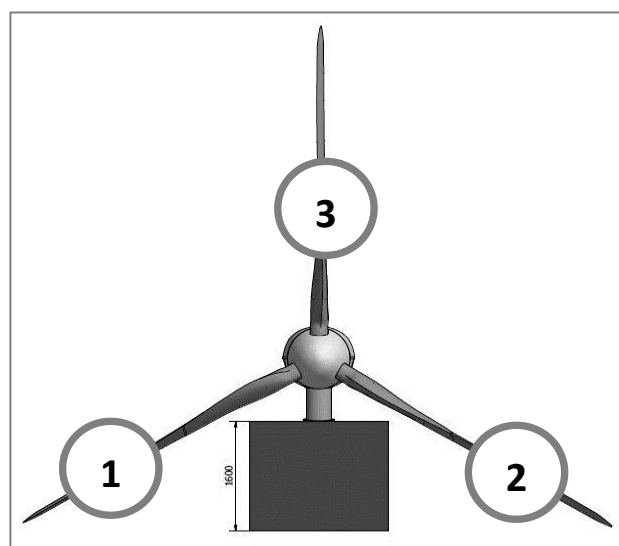
Blades Installation

The blades have only one mounting position. To avoid errors in the flange of the blade there is a larger diameter drill. This fits into the crown of the variable pitch so that it only has one installation position.



Order to installation

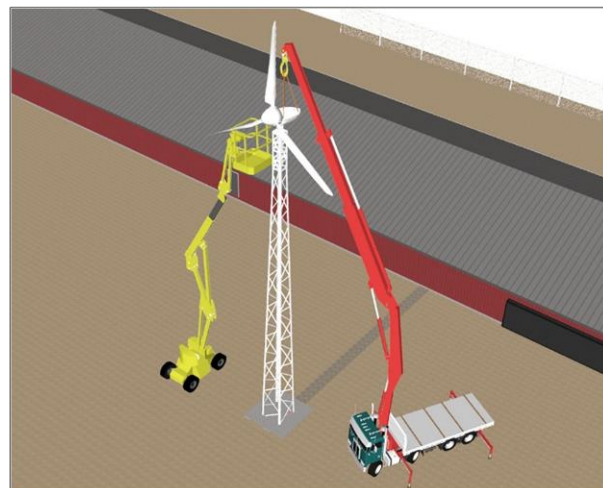
The order of the blades 1 and 2 can be interchanged, but the blade 3 must always be the last one. To place the blades correctly, the blades 1 and 2 must be picked up with soft straps in the manner shown in the diagram below.



Raise the wind turbine and screw the tower

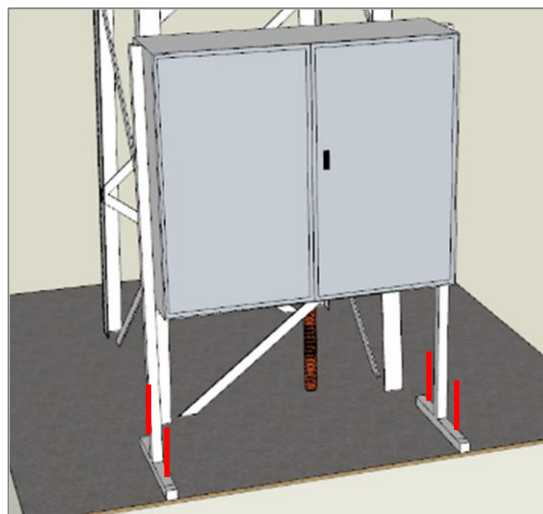
With all the blades already assembled, the upper casing is removed and the entire wind turbine is taken from the special rings it has inside to raise it to the top of the tower.

Once the crane is located at the top one or two operators from a platform lift or from another crane with basket, screw the wind turbine to the tower and make the electrical connections of the cables between the tower and the nacelle.



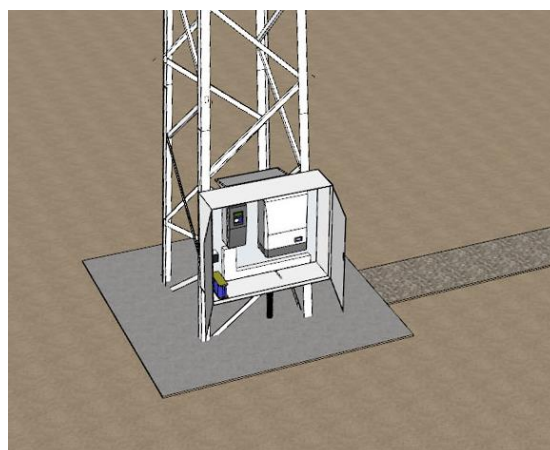
Control box installation

The electrical panel is placed on the foundation of the tower, making holes in the concrete and screwing the structure to the ground.



Electrical installation

Once the installation of heavy parts, the third day is to carry out the electrical installation, connections and commissioning of the installation, all the cables of the wind turbine are Plug & Play, except power.



Each cable is labeled unequivocally both at the tip of the cable to be connected, and at the connection terminal.



Electrical cables:

From the wind turbine there are 3 cable hoses:

- **Power cable hose**

The power hose has no end fitting, is identified by its larger size and is marked with U2, V2 and W2.

- **Auxiliary cable hose**

The supply hose goes to the connector marked **"Auxiliary Power"**



- **Signals cable hose**

The Signal Hose goes to the connector marked "Signals" and the connector has more internal connections.

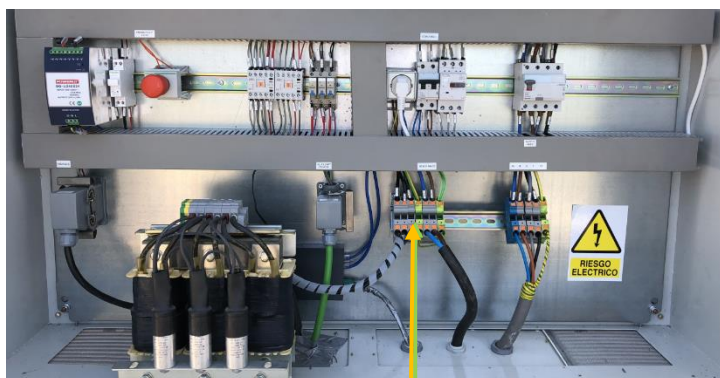
The signal hose should be as separate as possible from the other two, recommended to be installed by a different one from the tower cone shown in photo 2.



Photo 2, interior tower view

Ground connection tower

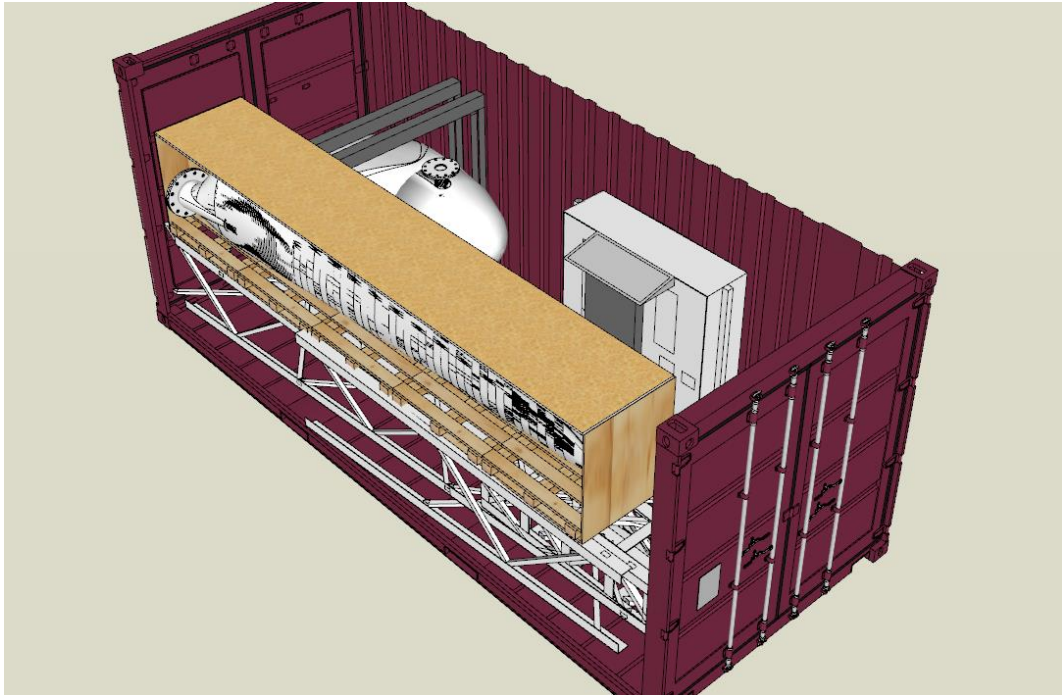
The tower should be connected to a grounding rod, about 2 meters long, and the internal connections of the board should also be connected to this rod.



9. TRANSPORT

20ft container

A complete Enair 200 wind turbine is located in a 20-foot container with the lattice tower included and completely disassembled.



10. Preventive maintenance program

The ENAIR 200 is designed to work optimally with minimum maintenance, in compliance with the same, the equipment will have a useful life of more than 25 years.

Maintenance works:

The components of the ENAIR 200 must only be handled by competent technical personnel. Under no circumstances will unqualified personnel be responsible for maintenance operations, unless directly directed by a qualified technician.

All fasteners that are handled during maintenance must be tightened with a torque wrench according to the table of suitable tightening torques.

The frequency of maintenance operations depends on the type of wind that has the installation site.

The maintenance will have a different execution schedule depending on the kind of wind where the Wind Turbine is installed.

Wind class:

Wind class	Average wind speed at the installation site		
	m/s	km/h	mph
1	<5.6	<20.1	<12.53
2	5.6 – 6.4	20.1 – 23.04	12.53 – 14.32
3	6.4 - 7	23.04 – 27.2	14.32 – 15.66
4	7 – 7.5	25.2 – 27	15.66 – 16.78
5	7.5 - 8	27 – 28.8	16.78 – 17.9
6	8 – 8.8	28.8 – 31.68	17.9 – 19.69
7	>8.8	>31,68	>19.69

ATTENTION: Not following the maintenance plan of the wind turbine cancels the warranty.



A. Maintenance schedule



According to the previous table where the wind classes of each place are located, the following maintenance program will be established, either every 12 or every 6 months.

Wind clas	1	2	3	4	5	6	7
Revision and re-tightening of screws of rotating shaft, hydraulic power station and tower blades.	30 or 60 days after installation, depending of wind conditions.						
Visual inspection (both of the mill and the tower), check of anomalous noises and vibrations	30 or 60 days after installation, depending of wind conditions and after storms or winds over 25 m / s (90 km / h, 56 mph)						
1 - Checking the condition of the blades, special attention to the leading edge							
2 - Retightening of screws, established in Pto.B.1, axis of rotation with tower.							
3 - Greasing of central bearing and crowns of variable pitch and rotation.							
4 - Greasing variable step assembly, actuator and limit switches							
6 - Revision of the hydraulic power station of its joints, hoses, oil level.							
7 - Checking the electrical connections in the nacelle and in the connection boxes.							
8 - Retighten other screws in the tower (eg splices, couplings ...)							
9 - Change oil in the hydraulic power station.	Every 4 years (indicative)			Every 4 years (indicative)			
10- Change the tubes of hydraulic power station.	Every 4 years (indicative)			Every 4 years (indicative)			





ATTENTION: Not following the maintenance plan of the wind turbine cancels the warranty.

ATTENTION: Do not perform any maintenance operation with strong winds, if you are in the middle of a storm and you have not performed the maintenance, you must stop the Wind Turbine while waiting for the storm to pass.

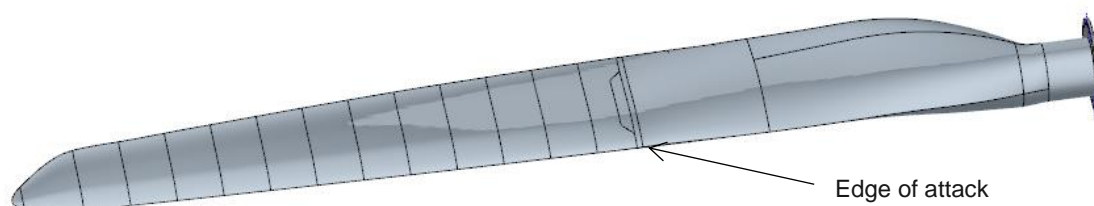
ATTENTION: Before carrying out any maintenance operation, stop the mill, using the stop switch.

B. Wind turbine revision

1 – Verification of the blades.

Check the surface of the blades, paying special attention to the leading edge; It is normal to see a slight wear. In case of finding large defects in its surface replace the set of the three blades.

In case of any crack or surface damage due to a collision, you must putty and paint with the recommended paint.



Paint inspection

Inspect the entire exterior surface of the ENAIR. If necessary, repaint.

Características de la pintura		
White Paint	Polyurethane paint, RAL 9003	High resistance to corrosion and ultraviolet radiation
Black Paint	Polyurethane paint, RAL 9004	

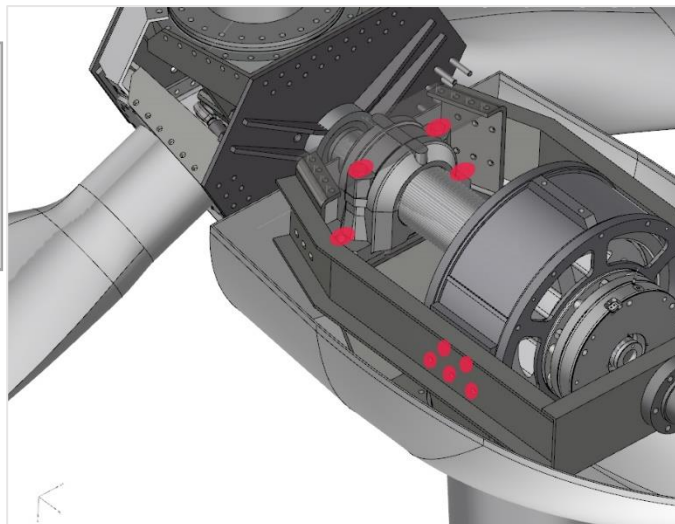


2 - Retightening of screws, established turning axis with tower.

The main screws must be checked at each wind turbine inspection to ensure that they are correctly tightened.

Tools	Torque
Socket wrench of 30	- 402 Nm
Socket wrench of 36	- 691 Nm
Socket wrench of 24	- 198 Nm

See Appnedix 3, for torque details.
Torque wrenches

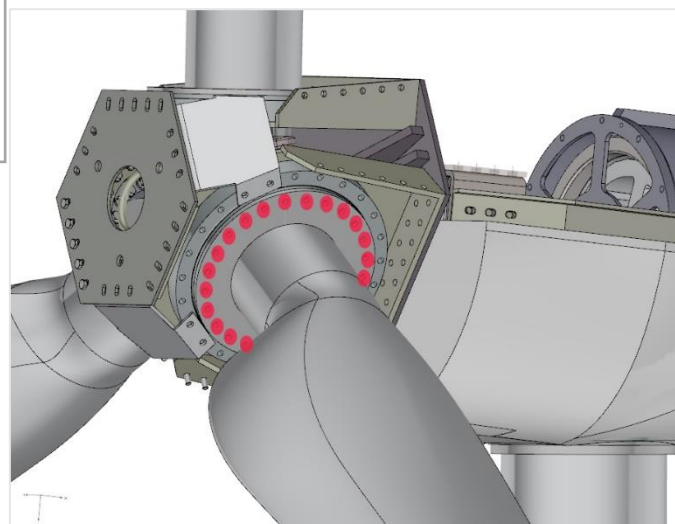


To carry out the tightening, lubrication and inspection tasks for each maintenance task, the cone of the wind turbine must be removed.

For each of the blades, the screws indicated should be checked, according to the torque characteristics attached..

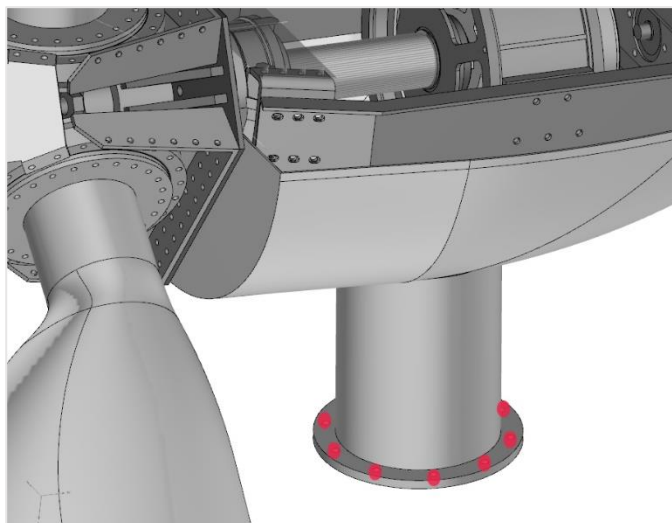
Tools	Torque
Socket wrench of 21	- 127 Nm

See Appnedix 3, for torque details.
Torque wrenches



Tools
Socket wrench of 24 - 198 Nm

See Appnedix 3, for torque details.
Torque wrenches



3 - Lubrication of the central bearing and variable pitch and rotation crowns.

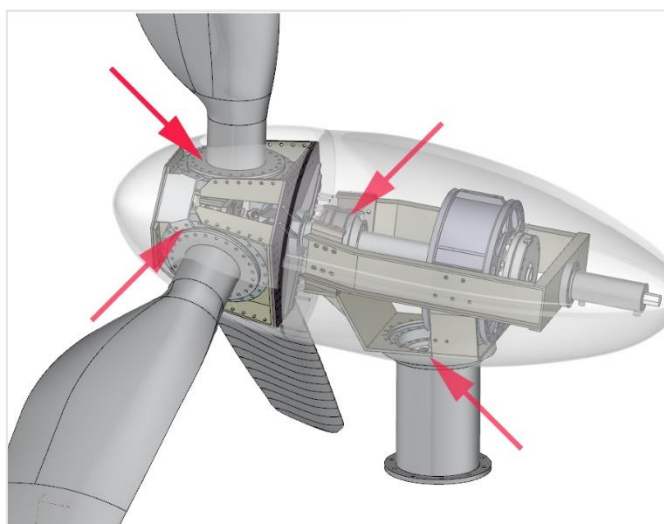
In every revision of the wind turbine, all the crowns and bearings must be lubricated correctly so that they are always perfectly lubricated, consider that the crowns have several lubrication points and it will be necessary to guarantee a correct greasing of the same.

Type of Grass:

- ISO 6074(HV)
 - DIN 51524
 - USS 126-127
 - ISO 6743 HM
 - MIL-L24459
- Required about 500gr.

Tools:

Standard grease nipple for grease nipples.



4 – Greasing of variable step assembly, actuator and limit switches.

In every revision of the wind turbine, all moving parts of the interior of the variable steep must be covered with grease, in order to guarantee smooth movement of the mechanisms.

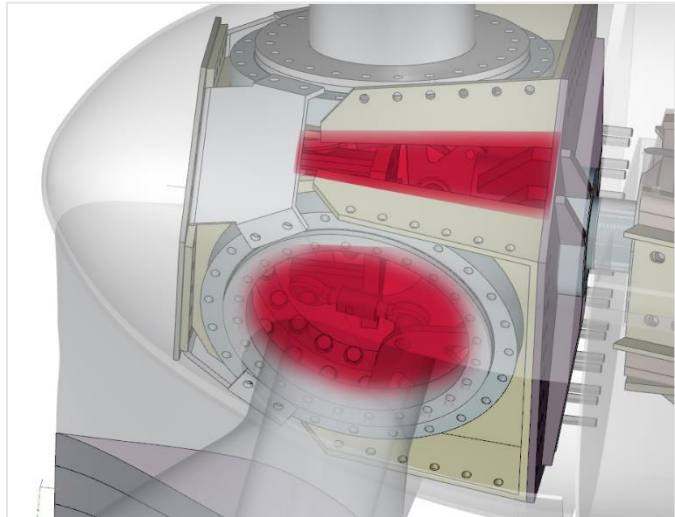
To do the internal lubrication it is **NOT necessary to remove the Blades**, it is done by the spaces between them.

Type of Grass:

- ISO 6074(HV)
 - DIN 51524
 - USS 126-127
 - ISO 6743 HM
 - MIL-L24459
- Required about 500gr.

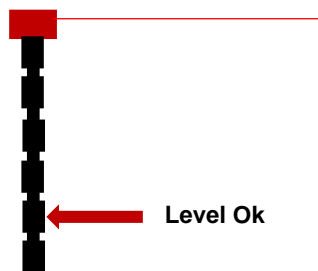
Tools:

Any wide brush.



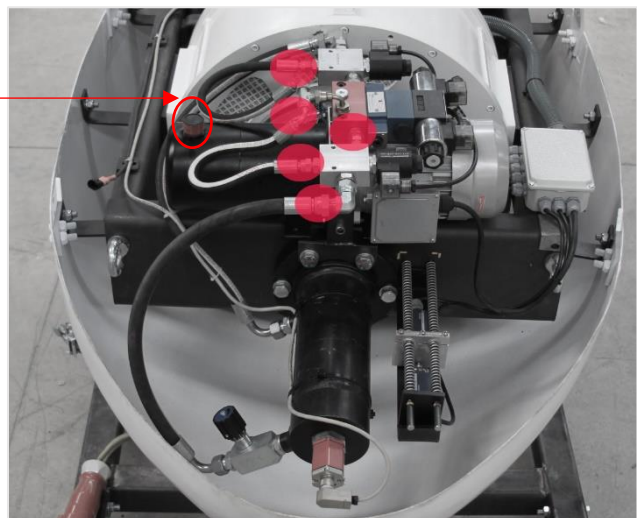
5 – Check the hydraulic unit of its seals, sleeves, oil level.

At each inspection of the Wind Turbine, the seals of each of the sleeves connected to the hydraulic power unit must be checked for oil leakage, and these sleeves must be replaced every 4 years for safety reasons. The oil level in the tank should also be checked and should be at least as far as the second mark on the gauge.



Type of Oil:

- ISO-L-XECHA 2
 - NSF H1
 - Low temperature - 50°C
- Norm ASTM D1478.



Caution: the hydraulic unit oil and sleeves must be changed every 4 years.

6 – Review of electrical connections.

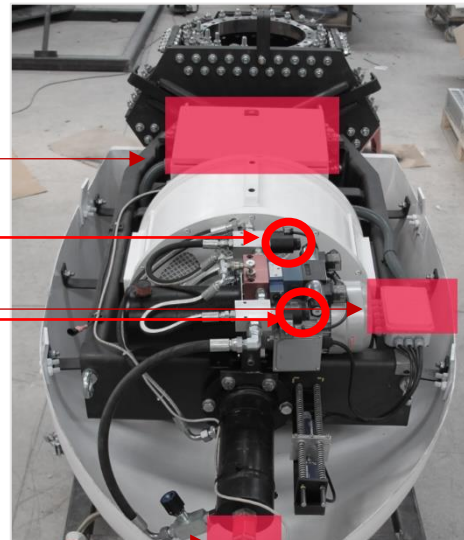
The electrical connections as well as the integrity of the cables must be perfectly checked, observing that there are no loose or overheated cables. The task to be performed is to visually check the cables and touch them by lightly pulling on them so that they are securely fastened.

Also check the integrity of the quick connect connectors for moisture, corrosion and dust.

Check the solenoid valves of the hydraulic unit so that they are tight and make good contact.

Connections, box:

The following junction boxes must be checked.



Fast connectors:

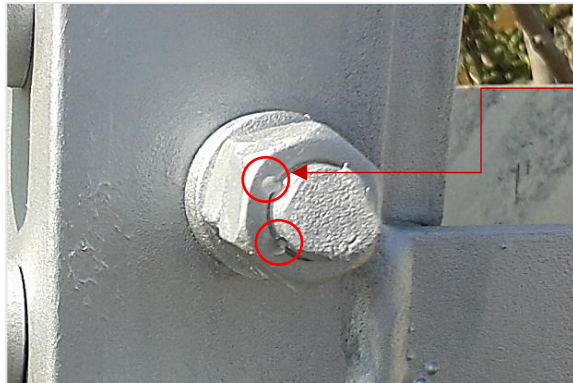
Visual check of the integrity and tightness of the quick connectors.



C. Tower inspection

1 – Retighten the tower screws.

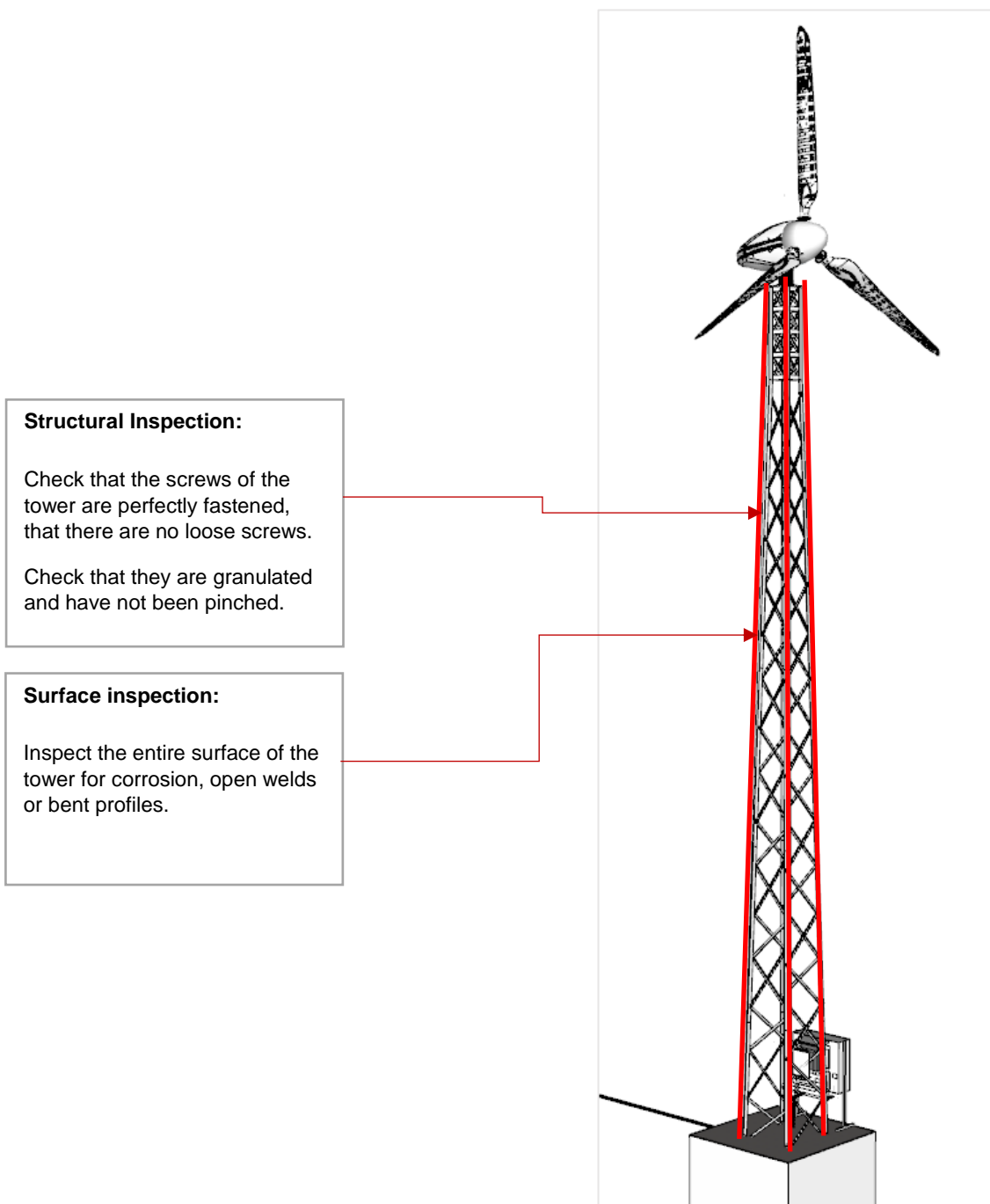
For the standard cases of square lattice towers, all the screws of the tower must be checked and retightened during each maintenance to verify the integrity of the tower, these screws must also be punched as shown in the photo below.



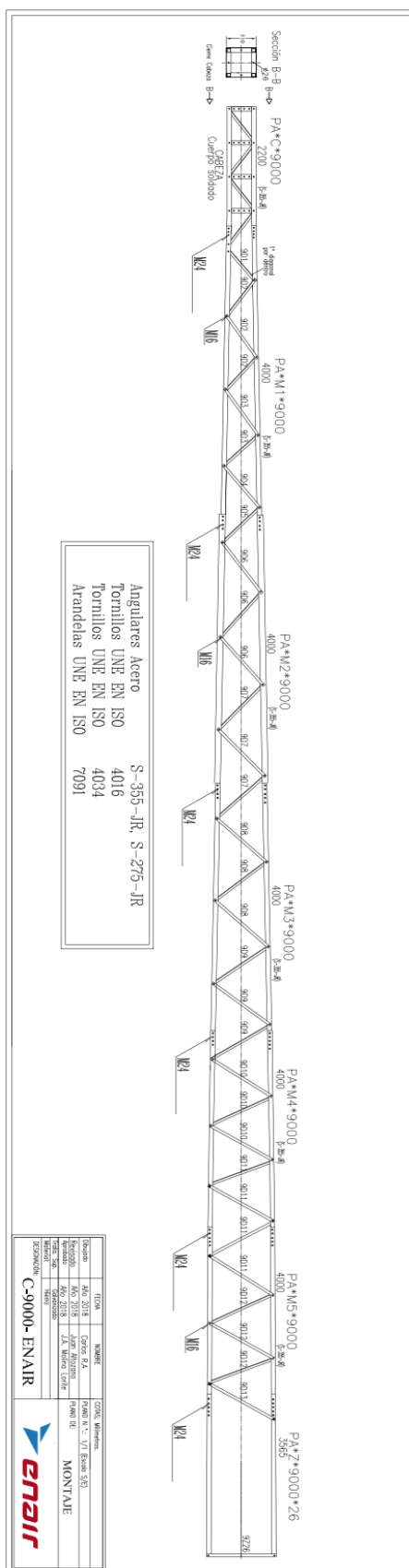
Inspection:

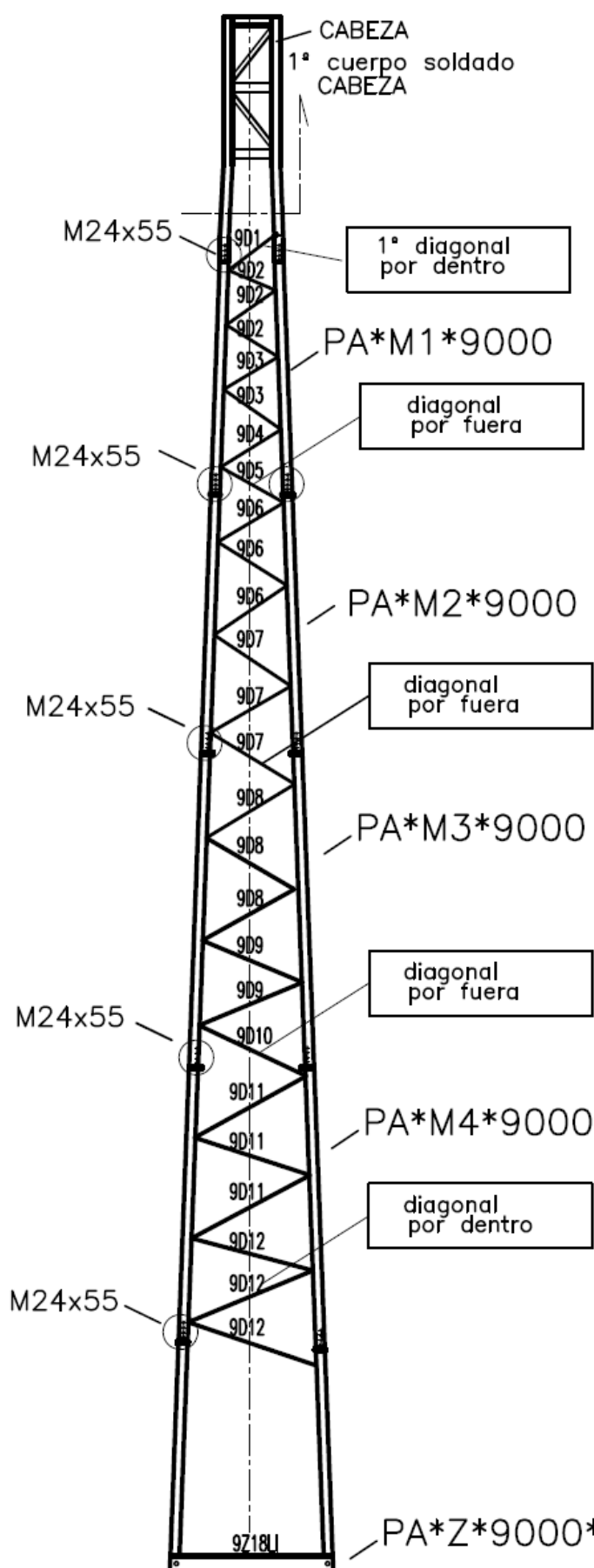
Punching the screws is to ensure that they do not loosen.

It is important to verify that they are always tightened to the correct torque. Given the large number of tower screws, we recommend that you refer to the torque table in Annex 3.



ANNEX 1 Tower details.





Assembly recommendation:

It is recommended to sort the profiles on the floor by numbering and to assemble opposite sides so that they are then joined together.

These plans are for the standard tower of 18 meters free height, any other tower height will have its own manual with its own numbering of profiles.

RU-9000-22 METROS- (18 m LIBRE)

Esfuerzo del apoyo (-00 Kg)
Diagonal
n° diagonal
9D1 CELOSIA

Esfuerzo del apoyo (-000 Kg)
Zierre Zanguillo
Altura del apoyo
9Z22 CIERRE

CELOSIA CANTIDAD

9D1	4
9D2	12
9D3	8
9D4	4
9D5	4
9D6	12
9D7	12
9D8	12
9D9	8
9D10	4
9D11	12
9D12	12
9Z18LI	4

TORNILLERIA

MONTAJE	Cantidad	TORNILLOS
CELOSIAS	76	M16x40
	100	M16x45
MONTANTES	176	M24x55

The tower has to support 1200kg at the top and the following load data for the design:

ENAIR	Weight	Horizontal force
E200	1200kg	12206.63 DaN

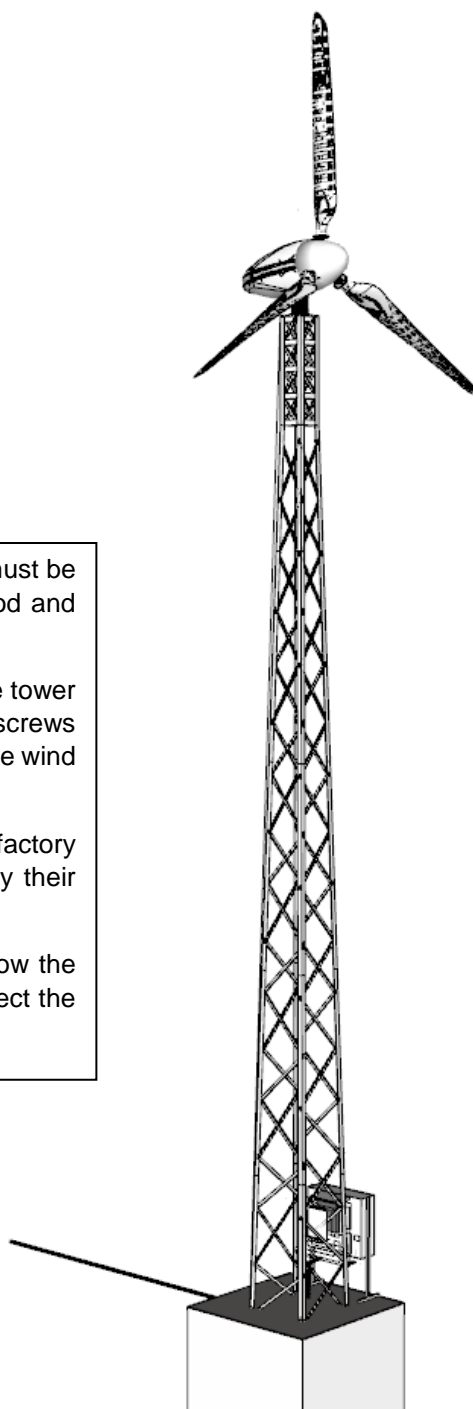
* The data supplied has been obtained in accordance with IEC 61400-2 including safety factor.

The welding straps on the tower head must be clean so that contact with the tip is good and vibration is avoided.

The connection between the head of the tower and the toe must be made with the screws calculated to support the stresses that the wind turbine + tower apply to the tower.

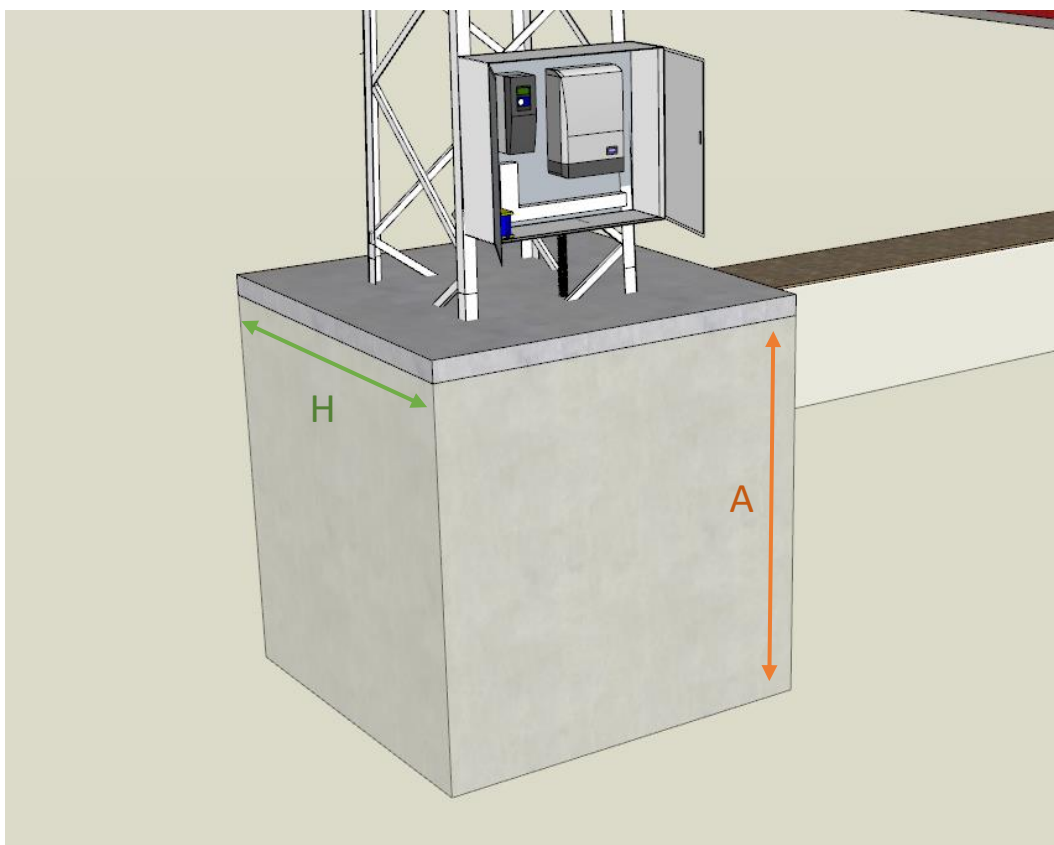
All towers not supplied by Enair must be factory approved and must be accompanied by their dynamic calculation memory.

Once the Wind Turbine is installed, follow the connection diagram in Annex 2 to connect the control panels.



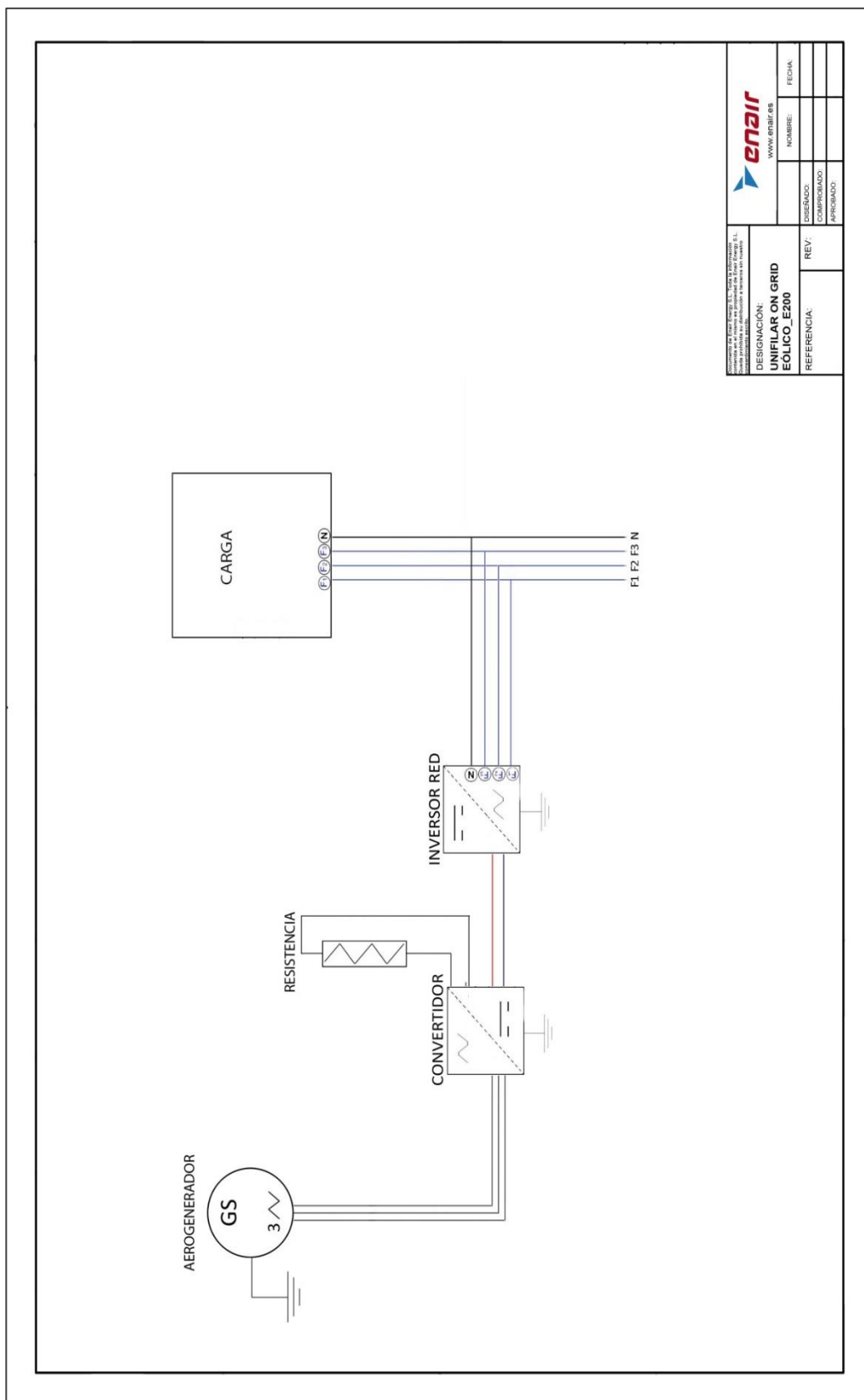
Tower Height (m)	Foundation						
	Side	K = 8		K = 12		K = 16	
	A(m)	H(m)	V(m ³)	H(m)	V(m ³)	H(m)	V(m ³)
16	2	3	12	2.86	9.10	2.66	8.40
18	2.7	3	22	2.87	10.80	2.67	10.00
20	3	3	27	2.54	13.30	2.67	13.00
22	3.2	3	29	2.87	15.70	2.67	14.60

ENAIR recommend use always the K=8 values






Note: In addition to the above measurements, the foundation should protrude 0.2m above ground level to prevent the effect of moisture on the base of the tower.

ANNEX 2 – Basic connection scheme



ANNEX 3 – Torque table

ISO 272			Clases de calidad de pernos de acero ISO 898-1													
			5,6		5,8		6,8		8,8		9,8		10,9		12,9	
d mm	ISO mm	mm	Cs- Nm	Fo	Cs- Nm	Fo	Cs- Nm	Fo	Cs- Nm	Fo	Cs- Nm	Fo	Cs- Nm	Fo	Cs- Nm	Fo
1,6**	0,35	3,2	0,075	234	0,105	327	0,12	374	0,16	499	0,18	561	0,235	732	0,275	857
2**	0,4	4	0,159	388	0,222	544	0,254	621	0,339	829	0,381	932	0,498	1 217	0,582	1 424
2,5**	0,45	5	0,33	648	0,463	907	0,529	1 036	0,705	1 382	0,793	1 555	1,04	2 030	1,21	2 375
3	0,5	5,5	0,57	972	0,8	1 362	0,91	1 556	1,21	2 075	1,38	2 335	1,79	3 048	2,09	3 567
4	0,7	7	1,3	1 685	1,83	2 359	2,09	2 696	2,78	3 594	3,16	4 044	4,09	5 279	4,79	6 178
5	0,8	8	2,59	2 759	3,62	3 862	4,14	4 414	5,5	5 886	6,27	6 626	8,1	8 645	9,5	10 116
6	1	10	4,49	3 891	6,2	5 448	7,1	6 226	9,5	8 302	10,84	9 334	14	12 194	16,4	14 269
8	1,25	13	10,9	7 145	15,2	10 003	17,4	11 432	23	15 242	26,34	17 146	34	22 388	40	26 198
10	1,5	16	21	11 379	30	15 930	34	18 206	46	24 275	52	27 313	67	35 655	79	41 724
12	1,75	18	37	16 594	52	23 231	59	26 550	79	35 401	90	39 835	116	51 995	136	60 845
14	2	21	59	22 789	83	31 905	95	36 463	127	48 618	143	54 570	187	71 408	219	83 563
16	2	24	93	31 385	130	43 939	148	50 216	198	66 955	224	75 422	291	98 340	341	115 079
18	2,5	27	128	38 123	179	53 373	205	60 998	283	83 746			402	119 454	471	139 787
20	2,5	30	182	49 039	254	68 655	291	78 463	402	107 941			570	153 657	667	179 811
22	2,5	34	250	61 326	350	85 857	400	98 123	552	134 806			783	192 157	917	224 865
24	3	36	313	70 616	438	98 863	500	112 986	691	155 489			981	221 266	1 148	258 928
27	3	41	463	93 042	649	130 259	741	148 868	1 022	204 577			1 452	291 534	1 700	341 157
30	3,5	46	628	113 045	880	158 263	1 005	180 872	1 387	248 811			1 969	354 209	2 305	414 500
33	3,5	50	854	141 009	1 195	197 412	1 366	225 614	1 884	310 343			2 676	441 828	3 132	517 033
36	4	55	1 096	165 409	1 534	231 573	1 754	264 655	2 418	363 974			3 435	518 282	4 020	606 501
39	4	60	1 424	198 910	1 994	278 474	2 279	318 257	3 139	437 669			4 463	623 253	5 223	729 339
42**	4,5	65	1 760	227 588	2 464	318 624	2 816	364 141	3 872	500 694			5 515	713 110	6 453	834 491
45**	4,5	70	2 203	266 613	3 085	373 258	3 525	426 580	4 847	586 548			6 903	835 386	8 079	977 579
48**	5	75	2 659	299 530	3 722	419 342	4 254	479 248	5 849	658 966			8 330	938 528	9 748	1 098 277
52**	5	80	3 425	359 684	4 795	503 558	5 480	575 495	7 335	791 306			10 731	1 127 011	12 558	1 318 843
56**	5,5	85	4 270	415 172	5 978	581 240	6 832	664 275	9 394	913 378			13 379	1 300 871	15 656	1 522 296
60**	5,5	90	5 306	485 416	7 428	679 583	8 490	776 666	11 673	1 067 916			16 625	1 520 971	19 455	1 779 860
64**	6	95	6 382	548 969	8 935	768 556	10 212	878 350	14 041	1 207 731			19 998	1 720 102	23 402	2 012 885